NOTES ON WEATHER IN OTHER PARTS OF THE WORLD.

Canada.—Montreal, January 12.—Several thousand unemployed found work to-day clearing [snow from streets as a result of the] blizzard last night. Drifts were 8 feet deep in places.—*New York Herald, January 12, 1922.*

Newfoundland.—St. Johns, January 25.—A blizzard which has raged in Newfoundland for the last 24 hours, piling up huge drifts, and the intense cold have resulted in the closing of many harbors. * * * The steamer *Stella Maris*, caught in the ice in Bonne Bay, was held so fast that it was believed there was little chance of her being able to get out before spring.—*New York Herald, January 26, 1922.*

Portugal.—Lisbon, January 21.—More than 50 deaths and incalculable damage to shipping, in addition to the unroofing of houses and uprooting of trees, resulted from the storm which swept Portugal early in the week. Reports from the northern Provinces have only just been received, as they were delayed through the breaking of communications. Many ships were driven aground by the gale.—*Chicago Post, January 21, 1922.*

Italy.—The exceptional drought and its serious consequences are still the topic of the day in northern Italy, says the London *Times*. In the Trentino the water of a lake has fallen so much that a small island never seen before within living memory has appeared in the middle. From an inscription on a stone on this island, the people learn that a great drought occurred in 1806 and that in that year, too, the small island emerged from the water. Father Gaddoni, of Imola, says that one must go back to the year 1621 to find another drought in the Po Valley similar to the present one.—*New York Evening Mail, January 20, 1922.*

Russia.—Riga, January 25.—Navigation has been suspended in the Gulf of Riga on account of ice, and shipping has become exceedingly difficult in the port of Reval.—*New York Herald, January 26, 1922.*

China.—The Yellow River, which created such havoc last August, has once more deserted its bed, carrying destruction to 13 Provinces. So sudden was the rise that the inhabitants were not able to get out of the way; whole villages were washed down the river and thousands of people were drowned. Great tracts were flooded in Shantung, Kiansu, and Ahnwei. The submerged area was estimated at about 10,000 square miles.—*The Pathfinder, January 14, 1922.*

Hawaii.—An iceberg, said to have been exposed 200 feet in length and rising 10 feet out of the water, was seen by passengers of the steamship *Shinyo Maru*, 25 hours out of Honolulu, on January 10 * * *.

This is believed to be the first time an iceberg has been seen off the Hawaiian Islands.—*Evening Star, Washington, D. C., January 16, 1922.*

Panama.—Panama, January 4.—Torrential rains have flooded the River Tuira, in the Province of Darien, and the villages of Pinogana and Yavisa are inundated.—*Washington Post, January 5, 1922.*

DETAILS OF THE WEATHER IN THE UNITED STATES.

GENERAL CONDITIONS.

The features which give individuality to the month were the persistence of anticyclones over the Great Basin region which seemed to be a point of concentration and of subsequent dispersion of anticyclones; uniformly high mean pressure in all parts of the country; irregular distribution of mean temperature and precipitation and at least three severe cyclonic storms, one of which No. IV of Chart III was the direct cause of much property loss along the middle Atlantic coast and No. XII which gave the remarkably heavy snow in the States of North Carolina, Virginia, Maryland, Delaware, the District of Columbia, and southeastern Pennsylvania.

The usual details follow.

Lows.	Alberta.	North Pacific.	South Pacific.	Northern Rocky Mountain.	Colorado.	Texas	East Gulf.	South Atlantic.	Central.	Total.
January, 1922....	8.0	1.0	2.0	.....	3.0	1.0	1.0	1.0	.....	17.0
Average number, 1892-1912, inclusive.....	4.7	2.5	0.9	0.4	1.4	1.5	0.4	0.4	0.5	12.7

Highs.	North Pacific.	South Pacific.	Alberta.	Plateau and Rocky Mountain region.	Hudson Bay.	Total.
January, 1922.....	3.0	1.0	5.0	.....	.....	9.0
Average number, 1892-1912, inclusive	0.8	0.6	5.5	1.7	0.4	9.0

CYCLONES AND ANTICYCLONES.

By W. P. DAY, Observer.

There was much similarity between the number and the predominating types of both HIGHS and LOWS in January as compared with December. The Plateau HIGH was persistent during much of the month. The unusual path of the Alberta HIGH of the 22d–31st which turned back on itself over Ontario was due to a reinforcement of pressure from the Hudson Bay region just as the Alberta HIGH was about to disintegrate. The two most severe storms of the month occurred off the middle Atlantic coast on the 11th and the 28th. The latter storm was halted off the Virginia Capes and turned at right angles to its previous path by the reinforcement of the previously mentioned HIGH (22d–31st).

FREE-AIR CONDITIONS.

By W. R. GREGG, Meteorologist.

Beginning with January, 1922, and monthly thereafter, there will appear in each number of the REVIEW a brief summary of the free-air conditions during that month, as observed by means of kites, balloons, airplanes, etc. The main purpose will be to discuss these conditions in relation to those at the surface and in relation to *normal* values at different levels—in effect, to present a review or survey of free-air conditions while they are still of current interest.

Table 1 gives for January the average values of temperature, relative humidity, and vapor pressure, together with departures from normal, and Table 2, resultant winds and normals, as determined from observations

with kites at the 6 primary aerological stations. Temperatures at all levels and at all 6 stations were not far from normal, there being a slight negative departure in all cases except above 1,000 meters at Groesbeck. Reference to Chart IV shows that temperatures at the surface were nearly normal in all parts of the country east of the Rockies, but that in the regions in which Broken Arrow, Drexel, and Ellendale are located there was a small positive departure. This discrepancy between Table 1 and Chart IV finds explanation in the fact that the aerological stations have been in operation for a comparatively brief period. The normals are therefore subject to some small revision as further observations are made, but this revision will almost certainly be less in the upper levels than near the surface.

The average temperature gradients are characteristic for this season of the year, except that at Groesbeck little change in temperature is shown from the surface to about 2,000 meters, whereas normally there is a decrease of about 4° C. At Ellendale there is the usual large winter inversion and at Drexel a moderate inversion. The other three stations show rather small lapse rates. Generally speaking, the largest inversions occurred during the coldest weather, but there were some exceptions. For example, at Ellendale on the 18th a moderate lapse rate was found above abnormally low temperatures at the surface. The free-air winds on this date were from the north—a very good illustration of the high correlation between free-air temperatures and winds—at any rate up to moderate heights in this country.

The lowest temperature, −26.2° C., was observed on the 15th at Ellendale at an altitude of 3,500 meters.

Relative humidity was generally somewhat above normal except at Royal Center and in the higher levels above Broken Arrow and Ellendale.

Variations in vapor pressure from the normal were similar to those in temperature, viz, negative except above 1,000 meters at Groesbeck.

Resultant winds were from a more southerly point and of lower speed than normal except at Groesbeck. At this station NNE. winds prevailed in the lower levels and WSW. in the upper, the north and south components respectively being much more pronounced than is normally the case. The unusual temperature departures, already referred to, seem to bear a very close relation to these abnormalities in resultant winds.

The daily observations at these kite stations and also at several pilot-balloon stations in different parts of the country show that, with few exceptions, free-air winds at altitudes of 2 kilometers and higher were from a westerly direction. This is the usual condition in winter, except in the extreme south and possibly along the Pacific coast. At Key West easterly winds were found from the 2d to 9th and from the 19th to 25th, in each period being due to high pressure central over the Southern States or off the south Atlantic coast. Farther north this type of pressure distribution seldom extends to any great height in winter because of the strong latitudinal temperature gradient. At Key West, however, the gradient is usually small. This was true particularly on the 4th and 5th and from the 20th to 23d when easterly winds prevailed up to altitudes of 7 to 10 kilometers, possibly higher.

The same general observation applies to the Pacific coast region where it is unusual to find a marked latitudinal temperature gradient, but where on the other hand the isotherms quite closely follow the coast line. As a result the anticyclonic and cyclonic systems extend as such to great heights and the wind directions at the surface and in the free air are not greatly different. At San Francisco easterly winds were observed in the upper levels from the 8th to 12th and from the 19th to 23d; and at San Diego from the 10th to 13th and on the 23d and 24th.

In other parts of the country, as already stated, free-air winds were prevailingly from a westerly direction, i. e., SSW. to NNW., mostly between SW. and NW., the usual condition in winter. A notable exception occurred from January 26 to 30, when easterly winds were observed at heights of 3 to 7 kilometers over nearly all of the country east of the Rocky Mountains. During this period a large and well-developed anticyclone was central over the lower Lakes and the St. Lawrence Valley. When it first appeared in North Dakota on the 22d, and from then until the 24th, while it was moving eastward, it was attended by very low temperatures, with the result that there was a strong gradient of temperature from south to north. Hence, the winds a short distance above the surface, irrespective of their direction at the latter, were westerly. From the 25th to the 30th, however, the anticyclone was practically stationary in position and diminished somewhat in intensity, the temperatures in its northern and central portions meanwhile moderating considerably. The resulting temperature gradient from south to north was small, amounting to only 20° to 30° F. from the upper Lakes to the Gulf on the 27th, not enough to cause a reversal of pressure gradient in the free air below heights of 4 to 7 kilometers.

This occurrence is a very good example of the intimate relation between free-air winds and surface temperature distribution, the latter being far more influential than the sea level *pressure* distribution. This relation may be expressed thus: (*a*) If the temperature is fairly uniform over wide areas, the free-air winds conform closely to the surface isobars and show that anticyclones and cyclones extend as such to great altitudes; (*b*) if, on the other hand, the latitudinal temperature gradients are steep at the surface and also, though to a less extent, in the higher levels, then the free-air winds very quickly show decided shifts from those at the surface; in other words, the surface pressure systems lose their identity at a very low altitude, the isobars opening out on the north side of cyclones and on the south side of anticyclones, and at still higher levels becoming practically parallel over wide areas.

During this period of easterly free-air winds a fairly active cyclone formed over the Florida Peninsula and moved slowly north-northeastward along the Atlantic coast. By the morning of the 28th it had reached the Virginia capes, and during that day there was heavy snowfall over Virginia, North Carolina, Maryland, and the District of Columbia. This was a typical "coast storm." It seems likely that the intensity of such storms, so far as precipitation is concerned, is intimately related to the depth of the easterly winds to the north and northwest of them. These cause a tremendous uplift of the warmer air which they underrun and a consequent condensation of large masses of water vapor.

TABLE 1.—*Free-air temperatures, relative humidities and vapor pressures during January, 1922.*

TEMPERATURE (°C).

Altitude. M. S. L. (m).	Broken Arrow, Okla. (233m.).		Drexel, Nebr. (396m.).		Due West, S. C. (217m.).		Ellendale, N. Dak. (444m.).		Groesbeck, Tex. (141m.).		Royal Center, Ind. (225m.).	
	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.
Surface	2.2	— 2.1	— 7.1	— 1.1	6.3	.....	—12.2	— 2.3	5.6	— 3.2	— 5.8	— 2.7
250	2.2	— 2.1	.....	.....	6.1	.....	.....	.....	5.2	— 3.2	— 5.8	— 2.6
500	1.5	— 2.3	— 7.3	— 1.2	4.6	.....	—11.9	— 2.0	4.5	— 2.9	— 6.2	— 1.9
750	0.9	— 2.7	— 6.8	— 0.9	4.1	.....	—10.4	— 0.8	4.9	— 2.2	— 6.2	— 1.5
1,000	0.7	— 3.0	— 6.3	— 1.4	3.6	.....	— 9.1	— 1.0	6.4	— 0.7	— 6.5	— 1.8
1,250	0.8	— 2.9	— 5.9	— 1.6	3.0	.....	— 8.5	— 1.3	7.1	+ 0.5	— 6.6	— 1.8
1,500	0.7	— 2.5	— 6.0	— 1.7	2.3	.....	— 8.9	— 1.6	7.0	+ 1.2	— 7.0	— 2.0
2,000	— 0.2	— 1.8	— 7.6	— 2.3	0.7	.....	—10.6	— 1.5	5.5	+ 1.3	— 7.4	— 1.7
2,500	— 2.1	— 2.1	— 9.7	— 2.4	— 1.1	.....	—12.3	— 1.0	2.8	+ 0.8	— 9.6	— 2.6
3,000	— 4.4	— 1.8	—11.6	— 1.9	— 3.1	.....	—15.1	— 1.1	0.5	+ 0.8	—11.6	— 2.3
3,500	— 6.5	— 1.7	—14.6	— 2.6	— 5.1	.....	—18.2	— 1.4	— 1.9	+ 1.0	—13.8	— 2.1
4,000	— 9.0	— 2.9	—17.9	— 3.3	— 7.3	.....	.....	.....	— 4.3	+ 1.4	.....	.....
4,500	—12.1	.....	—21.7	— 4.3	—10.1	.....	.....	.....	— 7.9	+ 0.4	.....	.....
5,000	—15.1	.....	—24.7	.....	—12.6	.....	.....	.....	—11.9	— 0.2	.....	.....

RELATIVE HUMIDITY (%).

Altitude. M. S. L. (m).	Broken Arrow, Okla. (233m.).		Drexel, Nebr. (396m.).		Due West, S. C. (217m.).		Ellendale, N. Dak. (444m.).		Groesbeck, Tex. (141m.).		Royal Center, Ind. (225m.).	
	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.
Surface	72	—3	82	0	68	.....	86	+7	78	—1	70	—10
250	72	—2	.....	.....	68	.....	.....	.....	77	0	70	—9
500	68	+2	81	+2	67	.....	84	+6	75	0	61	—14
750	64	+4	76	+3	65	.....	76	+4	73	+3	57	—13
1,000	59	+5	73	+6	65	.....	70	+6	67	+5	55	—9
1,250	54	+4	69	+8	65	.....	65	+6	61	+4	52	—6
1,500	50	+3	64	+6	67	.....	63	+6	58	+5	50	—3

RELATIVE HUMIDITY (%)—Continued.

Altitude. M. S. L. (m).	Broken Arrow, Okla. (233m.).		Drexel, Nebr. (396m.).		Due West, S. C. (217m.).		Ellendale, N. Dak. (444m.).		Groesbeck, Tex. (141m.).		Royal Center, Ind. (225m.).	
	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.
2,000	46	+4	60	+4	62	.....	57	0	55	+9	42	—5
2,500	42	0	58	+3	64	.....	53	—4	58	+16	45	0
3,000	34	—11	57	+1	62	.....	53	—4	56	+17	46	—2
3,500	32	—22	60	+6	61	.....	54	—3	51	+13	43	—10
4,000	30	—11	66	+14	59	.....	.....	.....	44	+8	.....	.....
4,500	30	.....	69	+16	59	.....	.....	.....	43	+9	.....	.....
5,000	30	.....	68	.....	60	.....	.....	.....	42	.....	.....	.....

VAPOR PRESSURE (*mb.*).

Altitude. M. S. L. (m).	Broken Arrow, Okla. (233m.).		Drexel, Nebr. (396m.).		Due West, S. C. (217m.).		Ellendale, N. Dak. (444m.).		Groesbeck, Tex. (141m.).		Royal Center, Ind. (225m.).	
	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.	Mean.	Departure from normal.
Surface	5.53	—1.08	2.93	—0.51	7.25	.....	2.23	—0.31	7.65	—1.89	2.91	—1.38
250	5.51	—1.03	.....	.....	7.12	.....	.....	.....	7.38	—1.59	2.85	—1.31
500	5.01	—0.60	2.82	—0.44	6.34	.....	2.20	—0.30	6.81	—1.45	2.55	—1.11
750	4.54	—0.45	2.77	—0.13	6.16	.....	2.14	—0.15	6.75	—0.73	2.39	—0.93
1,000	4.04	—0.39	2.74	0.00	5.96	.....	2.09	—0.13	6.69	+0.21	2.23	—0.67
1,250	3.65	—0.38	2.63	+0.06	5.50	.....	1.97	—0.20	6.36	+0.66	2.10	—0.57
1,500	3.26	—0.36	2.44	+0.01	5.18	.....	1.85	—0.18	6.04	+1.05	1.98	—0.39
2,000	2.75	—0.14	2.02	—0.14	4.45	.....	1.52	—0.27	5.17	+1.29	1.64	—0.31
2,500	2.23	—0.59	1.64	—0.21	4.03	.....	1.29	—0.14	4.61	+1.55	1.53	—0.14
3,000	1.61	—0.99	1.39	—0.18	3.48	.....	1.07	—0.02	3.78	+1.30	1.28	—0.24
3,500	1.42	—1.19	1.19	—0.11	3.04	.....	0.97	+0.15	3.01	+0.91	1.07	—0.20
4,000	1.28	—0.65	1.01	—0.04	2.74	.....	.....	.....	2.32	+0.56	.....	.....
4,500	1.18	.....	0.64	—0.29	2.59	.....	.....	.....	2.09	+0.43	.....	.....
5,000	1.10	.....	0.31	.....	2.48	.....	.....	.....	1.88	.....	.....	.....

TABLE 2.—*Free-air resultant winds (m. p. s.) during January, 1922.*

Altitude. M. S. L. (m.)	Broken Arrow, Okla. (233m.)				Drexel, Nebr. (396m.)				Due West, S. C. (217m.)		Ellendale, N. Dak. (444m.)				Groesbeck, Tex. (141m.)				Royal Center, Ind. (225m.)			
	Mean.		Normal.		Mean.		Normal.		Mean.		Mean.		Normal.		Mean.		Normal.		Mean.		Normal.	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Surface	N.88° W.	0.3	S.33° W.	0.8	S.59° W.	0.9	N.82° W.	1.6	N. 17° W.	0.5	N. 80° W.	2.7	N. 54° W.	3.3	N. 22° E.	2.3	N. 30° W.	0.9	S. 57° W.	1.7	S. 50° W.	2.3
250	S. 50° W.	0.4	S. 30° W.	1.2	.....	.....	.....	.....	N. 34° W.	0.7	.....	.....	.....	.....	N. 24° E.	3.0	N. 41° W.	0.9	S. 69° W.	2.1	S. 46° W.	2.8
500	S. 16° E.	2.1	S. 34° W.	2.2	S. 55° W.	1.7	N. 76° W.	2.7	N. 73° W.	1.6	N. 87° W.	3.0	N. 55° W.	3.9	N. 30° E.	3.0	S. 83° W.	1.4	S. 52° W.	3.4	S. 60° W.	5.0
750	S. 8° E.	2.9	S. 36° W.	3.3	S. 73° W.	3.5	N. 69° W.	4.6	W.	3.0	N. 87° W.	4.1	N. 59° W.	6.1	N. 33° E.	2.0	S. 75° W.	2.6	S. 65° W.	4.4	S. 67° W.	7.3
1,000	S.	3.5	S. 57° W.	3.8	S. 75° W.	4.0	N. 71° W.	5.8	S. 87° W.	3.7	N. 76° W.	4.8	N. 59° W.	11.0	N. 16° E.	0.6	S. 74° W.	3.4	S. 87° W.	6.5	S. 73° W.	7.8
1,250	S. 19° W.	3.6	S. 70° W.	4.0	S. 79° W.	6.1	N. 70° W.	7.0	S. 77° W.	6.0	N. 75° W.	6.1	N. 62° W.	8.6	N. 83° W.	2.0	S. 80° W.	4.4	N. 86° W.	7.8	S. 77° W.	9.3
1,500	S. 31° W.	3.6	S. 57° W.	6.3	S. 83° W.	7.2	N. 69° W.	8.2	S. 82° W.	6.9	N. 81° W.	5.9	N. 59° W.	9.1	S. 80° W.	3.6	S. 88° W.	5.6	N. 75° W.	9.7	S. 80° W.	10.4
2,000	S. 64° W.	5.2	S. 66° W.	9.1	S. 88° W.	8.9	N. 70° W.	10.6	N. 89° W.	8.5	N. 79° W.	7.7	N. 62° W.	11.2	S. 74° W.	8.1	S. 88° W.	6.5	N. 79° W.	10.8	S. 82° W.	12.4
2,500	S. 74° W.	7.4	S. 83° W.	9.8	N. 88° W.	11.1	N. 78° W.	12.6	N. 80° W.	12.1	N. 76° W.	9.9	N. 62° W.	13.2	S. 66° W.	11.6	W.	7.4	S. 87° W.	13.4	W.	14.3
3,000	S. 78° W.	10.1	N. 80° W.	12.3	S. 89° W.	13.1	N. 76° W.	14.4	N. 78° W.	17.1	N. 74° W.	13.3	N. 65° W.	14.6	S. 66° W.	13.9	N. 89° W.	9.0	S. 86° W.	12.5	N. 88° W.	14.3
3,500	S. 87° W.	9.9	N. 71° W.	14.0	N. 79° W.	14.5	N. 77° W.	15.5	N. 83° W.	17.3	N. 74° W.	12.3	N. 65° W.	16.2	S. 72° W.	13.2	N. 78° W.	11.0	N. 74° W.	16.6	S. 71° W.	12.8
4,000	S. 68° W.	15.0	N. 68° W.	19.3	N. 86° W.	16.7	N. 84° W.	17.2	N. 69° W.	16.9	N. 54° W.	17.6	N. 59° W.	17.8	S. 46° W.	16.7	N. 63° W.	11.8	.....	.....	S. 63° W.	17.3
4,500	S. 68° W.	16.3	.....	.....	N. 56° W.	12.9	N. 84° W.	18.8	N. 45° W.	17.6	.....	.....	N. 49° W.	19.1	S. 54° W.	18.5	N. 44° W.	9.2	.....	.....	.....	.....
5,000	W.	17.6	.....	.....	W.	15.0	W.	18.9	N. 45° W.	17.8	.....	.....	N. 76° W.	17.3	S. 68° W.	21.6	W.	13.0	.....	.....	.....	.....

THE WEATHER ELEMENTS.

By P. C. DAY, Climatologist and Chief of Division.

(Weather Bureau, Washington, D. C.)

PRESSURE AND WINDS.

Probably the most important feature of the atmospheric pressure distribution for the month was the persistence and strength of the Plateau high area. Save for a few days at the beginning of the month, a short period slightly after the middle, and again toward the end, the pressure over this region was continually high. At Baker City, Oreg., the sea-level pressure on the 11th, 31.02 inches, was the highest ever observed at that station.

For the month as a whole pressure was above normal over all portions of the United States, save in a small section of the far Southwest, where there was a slight deficiency. In the Canadian Provinces average pressures were likewise above normal over the central and eastern districts, but over the western Provinces there was a tendency toward slight deficiencies.

Compared with the previous month, pressure was higher in all districts, save in the Rocky Mountains and portions of the adjacent Great Plains.

From the middle and upper Mississippi Valley eastward the increases over the preceding month were important, ranging from 0.10 to 0.20 inch. In other districts the variations were distinctly less.

In the Plateau districts there was a general movement of the winds at the lower levels outward in all directions from the region of highest pressure, over southern Idaho and portions of adjacent States. In other districts wind directions varied greatly. Over the Atlantic and Gulf States and in portions of the Ohio Valley the winds were mainly from north or northeast points. In the middle Plains and portions of the Lake region they were largely from the south; elsewhere variable.